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SPECIFICATION FOR FREEZERS

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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SPECIFICATION FOR FREEZERS

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Indian Standard

SPECIFICATION FOR FREEZERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 17 November 1975, after the draft finalized by the Refrigeration and Air Conditioning Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 This standard has been prepared to establish minimum constructional and performance requirements of freezers. This standard is limited to the freezers fitted with vapour compression refrigeration system using natural or forced draught air-cooled condenser.

0.3 This standard does not apply to freezers or freezer compartments built in refrigerators or refrigerator-cum-freezer units or to the walk-in coolers. It excludes freezers for outdoor use or those kept in direct sun or exposed to salty or chemically polluted air blast.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the constructional requirements and methods of determining performance and computing the volume of freezers. In addition, it specifies type tests for performance. This standard covers freezers of storage volume from 50 to 1 000 litres capacity.

1.1.1 Freezers covered by this standard shall be capable of maintaining mean internal cabinet air temperature of —10°C and below at ambient temperature of 43°C.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

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*Rules for rounding off numerical values (*revised*).

2.1 Food Freezer — A thermally insulated cabinet intended for freezing and storing of food for short or long term storage application. Cabinet is specifically designed to maintain mean air temperature below −15°C by means of vapour compression refrigeration system.

NOTE — Short term storage means storage for at least one week. Long term storage means storage for at least one month.

2.2 Ambient Temperature — The temperature in the space surrounding the freezer under test.

2.3 Vapour Compression Cycle — A refrigeration cycle in which a volatile liquid absorbs heat, evaporates and is compressed to a higher pressure and temperature to return to its liquid state again, .by surrendering heat at a higher temperature and pressure.

2.4 Accumulator — A large diameter tube at the end of cooling coils, whose purpose is to store liquid refrigerant and prevent its entrance into the suction line. It provides a reservoir for fluctuation of the liquid refrigerant requirement to adjust with varying conditions of load under different ambient temperatures and is of such size that under the highest load conditions the last coil of the evaporator is not starved of liquid and under lowest load condition, the suction line is not frosted with liquid refrigerant.

2.5 Balanced Pressure — It is the pressure in the 'off' cycle at any point in the refrigeration system after the high and low sides have attained a condition of equilibrium.

2.6 The Average Freezer Air Temperature — The average air temperature taken by means of thermocouples or thermometers located at places in the freezer as shown in Appendix A at any point of the thermostatic cycle.

2.7 Cycles per 24 Hours — A cycle in the operation of a freezer is the period during which a compressor goes through the steps of starting, running, stopping and starting again. Cycles per day can be determined by dividing the number of complete cycles by the elapsed time in hours and multiplying the result by 24.

2.8 Percentage Running Time — The percentage running time, under given conditions of ambient temperature and of mean internal temperature, is the ratio:

$$R = \frac{d}{D} \times 100$$

where

d = duration of compressor operation during a full number of cycles, and

D = total duration of the cycles.

2.9 Overall Dimensions — Measurement of the outside rectangular dimensions over the horizontal base within which the freezer including its accessories other than the handle is inscribed.

2.10 Gross Volume — Total volume contained within interior walls of the freezer with the door closed and determined by the method given in **4.3**.

2.11 Storage Volume — The total volume contained inside the cabinet for storage of food. This will be equal to the gross volume minus volume of internal fittings as described in **4.4**.

3. CONSTRUCTION

3.1 General Design — The freezers and their parts shall be constructed with strength and rigidity adequate to withstand normal conditions of handling, transport and usage. Where an internal light is fitted, the lamp shall be effectively protected from mechanical damage but shall be accessible without excessive dismantling. There shall be no sharp edges or corners liable to cause injury to the user in the normal conditions of use. When used in railway coaching stock or motor vehicles, the freezer and its components, including piping and pipe connections, should be robust in design so as to withstand heavy vibrations and shock loads.

3.2 Materials — Materials used in the construction of the cabinet shall comply with Indian Standards wherever applicable, except where such requirements are modified by this standard. They shall be free from defects which are liable to cause undue deterioration or failure. Under normal conditions of use, the materials used shall not shrink, warp or cause odour and shall be resistant to attack by local vermins and destructive pests. Where liable to be exposed to moisture, chemically active substances and food or food products, they shall be suitably resistant and shall not contaminate stored products placed in contact with them. Sealing meterials used shall not loose in service, any of their essential properties, such as adhesiveness, plasticity and moisture resistance, due to ageing, temperature and humidity variations.

3.3 Finish — The interior and exterior finish shall be durable and capable of being cleaned effectively and hygienically without undue deterioration. All metal parts used inside or outside the freezer which are exposed to moisture or ambient conditions shall be corrosion resistant or adequately protected against corrosion.

3.4 Thermal Insulation — The quality, thickness and applicaton of the insulating meterial shall be such that insulation of the cabinet is efficient to maintain the required temperature inside the cabinet. There shall be proper seals against moisture penetration by diffusion or condensation. Detachable plates and covers in the cabinet shall be provided with suitable seals to prevent ingress of moisture into the insulation. Highly conductive external or internal surfaces shall be separated by insulating breaker strips or their equivalent. As far as possible, no member of the frame shall penetrate the full thickness of the insulation. External surfaces of the cabinet shall be free from moisture condensation under normal conditions of service.

3.5 Fittings — Linings and facing shall have sufficient mechanical strength to resist distortion and give reasonable protection to the insulation. When the doors of the refrigerated space are closed, there shall be no leakage of external air into the cabinet either past the door gaskets or by any other means.

3.6 Hardware — Door fasteners and hinges shall be smooth and positive in action and designed to maintain their proper function without undue wear under normal conditions of service. Screws and all other hardware shall be of corrosion resisting material.

3.7 Interior Fittings — The rails, shelves and baskets shall be sufficiently strong for the duty specified in **6.2.2**. The shelves shall be of welded metallic construction galvanized, chromium plated or of non-corrosive finished casting, not reacting with food in any way. The shelf supports shall be strong enough to take the load. The interior lining shall be of suitable metallic sheets or polystyrene materials and shall be non-corrosive.

3.8 Doors and Fittings — Hinges and handles shall be strong and resistant to corrosion. They shall be able to withstand the normal usage without adversely affecting the airtightness of the freezer. The opening of the door shall be sufficient to enable removable shelves or baskets to be easily withdrawn. In case of horizontal freezers the door hinges shall be spring loaded for easy closing and opening and for self-opening when the door latch is released.

3.9 Unrefrigerated Surface — Adequate mechanical spacing devices shall be provided to prevent frozen food packages from making direct contact with the surfaces, which are not directly refrigerated, where such spacers are required to allow air circulation to maintain the air temperatures required in the cabinet. If the floor of the cabinet is not directly refrigerated, the shelve shall be provided above the floor to allow adequate ventilation between the floor and the product if necessary to maintain the required cabinet product temperature.

3.10 Refrigeration System

3.10.1 *Construction* — The pipes and connections to moving or resiliently mounted parts shall be arranged so as not to foul or transmit vibration to other parts. The pipes and connections shall be securily fixed and should be of sufficient length to minimize the risk of failure due to vibration. The refrigerating system shall not have distinct nuisance noise in the normal running operation and should not transmit vibration to adjoining portions of the surroundings. The evaporator may be of suitably copper coated or plated steel, copper, brass or aluminium. Stainless steel may also be used for this purpose.

3.10.2 *Safety Features in Design* — The refrigerating system shall be assembled in accordance with good engineering practice. The refrigerating system shall be so designed that it will suffer no damage if the door of the cabinet is left open accidently for a short duration in ambient air of the temperature specified. During this period motor overload protective device may come into operation.

3.10.3 *Control of Operation* — Refrigerant flow and compressor motor shall be automatically controlled to reduce the cabinet temperature to the temperature specified and to maintain it within the limits of application. Strainer and dehydrator shall always be provided in the liquid line.

3.10.4 *Location of Components* — The evaporator, screens and shelves shall not obstruct access to the stored products. All control devices and service valves shall be readily accessible.

3.10.5 *Strength of Pressure Parts* — The parts of the refrigerating circuit subjected to internal pressure shall be perfectly tight. They shall be designed to withstand without permanent deformation and leakage the pressures given in Table 1.

TABLE 1 TEST PRESSURE

REFRIGERANT	PRESSURE (GAUGE)
Chlorodifluoromethane R-22	28·0 bar
Dichlorodifluoromethane R-12	17·0 bar

NOTE — When a system is such that its low side pressure cannot by reasons of its design, go beyond a maximum pressure of *Pm*, the test pressure shall be *Pm* × 1·3 provided such pressure does not exceed that shown in the table.

3.11 Electrical Components

3.11.1 The equipment shall be capable of working at 230 to 240 V in case of single phase or at 400 to 415 V in the case of three phase supply.

3.11.2 *Electric Motors* — Electric motors for hermetically sealed compressors shall be so constructed that the constant pressure of oil and refrigerant under working pressure and temperature has no adverse action of the insulation material and windings.

3.11.3 *Compressor Motor Overload Protector* — The compressor motor shall be connected through a current and temperature sensitive protecting device which is capable of automatically disconnecting the motor from the line in case the motor is electrically or thermally overloaded either during starting or running.

3.11.4 *Electrical Contacts* — Electrical contacts in relays and thermostats should be of snap action type and shall be of ample capacity to easily handle the locked rotor current, that is, the continuous current taken by the motor when its rotor is mechanically locked so as to prevent its rotation.

3.11.5 *Flexible Cord* — Freezers shall be fitted with a good quality wire which shall have ample capacity to carry the maximum current required without showing any sign of strain. They shall conform to the requirements of IS : 434 (Part I)-1964* or IS : 694 (Part I)-1964†, whichever is applicable. The wires shall be so arranged that there is no mechanical damage nor any damage due to heat, oil, moisture or corrosion. Whenever electrical connections have to be made, they shall be done with a suitable mechanical connection or the joint shall be soldered or brazed. The insulation used to electrically insulate these joints shall not be less than the value of the original insulation used on the wires. The electrical connection shall be either made by means of suitable mechanically tight connectors or their ends shall be soldered and formed into eyelets so that they can be securely held in position. Care shall be taken so that the insulation is not destroyed whilst performing the soldering operation. Corrosive fluxes shall not be used. All electrical connections and components shall be adequately guarded and insulated so that there is no chance of getting any accidental electrical shocks at any time during normal usage. Where any cord or cable passes through metal holes, such holes shall be so shaped as to protect the cord from damage or abrasion.

3.11.6 *Wiring* — Electrical wiring and connections shall conform to the requirements of IS : 732-1963‡ and also to the Indian Electricity Act, 1910 and Indian Electricity Rules, 1956. All electrical joints shall be electrically and mechanically secure.

3.11.7 *Accidental Contact* — Live parts shall be protected by suitable guards, shields or screens of adequate strength and durability to avoid the possibility of making inadvertent contact therewith during normal service conditions.

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*Specification for rubber-insulated cables: Part I With copper conductors (*revised*).

†Specification for PVC insulated cables (for voltages up to 1100 V): Part I With copper conductors (*revised*).

‡Code of practice for electrical wire installations (system voltage not exceeding 650V).

3.11.8 *Electrical Accessories* — All internal electrical fittings, such as lamps, and switches, shall be provided with guards for protection against mechanical damage and shall be suitable for operation at the lowest air temperature likely to occur.

3.11.9 *Terminals* — The materials, design and proportions of all terminals shall be such that connections made shall not slacken or overheat under the normal conditions of use. Terminals shall be such that conductors connected thereto are rigidly and effectively clamped between metal surfaces. Terminal screws and nuts shall engage for at least two full turns.

4. MEASUREMENT OF FREEZER STORAGE CAPACITY

4.1 Accuracy of Measurement and Units — Linear dimensions shall be measured to the nearest millimetre. Areas estimated shall be expressed in square decimetres. Volumes estimated shall be expressed in cubic decimetres or litres.

4.2 Inside Dimensions of the Cabinet

4.2.1 *Front Access Type*

4.2.1.1 *Inside depth* — This shall be mean horizontal distance between the front and the rear inside surface of the enclosed space of the cabinet.

4.2.1.2 *Inside width* — This shall be the mean horizontal distance between the inner surfaces of the side walls of the enclosed space.

4.2.1.3 *Inside height* — This shall be mean vertical distance between the inner surfaces of the floor and the ceiling of the enclosed space.

4.2.2 *Top Access Type*

4.2.2.1 *Inside depth* — This shall be the mean horizontal distance between the front and rear inner surfaces of the front and back walls of the enclosed space of the cabinet.

4.2.2.2 *Inside width* — This shall be the mean horizontal distance between the inner surfaces of the side walls of the enclosed space.

4.2.2.3 *Inside height* — This shall be the mean vertical distance between the inner surface of the floor and the lid or door.

4.3 Gross Volume — The gross volume of the freezer shall be the product of inside depth, inside width and inside height as defined in **4.2.1** and **4.2.2**.

NOTE — In case of intricate shapes of the liners, the total volume shall be divided into convenient units of volume of geometric shape. Volume of all such units shall be calculated from their mean inside dimensions and added to yield gross volume. Shapes formed in the wall of the food compartment and in the door (bulges, hollows, etc) are taken into account in calculating the gross volume. When the freezer is divided into compartments by fixed insulated partition, each compartment shall be regarded as a separate freezer for the purpose of computing volume and the sum of each of such volume shall be gross volume.

4.4 Storage Volume (Net Volume) — The storage volume shall be the gross volume or sum of the gross volumes of individual compartments less the volumes of internal fittings fixed in the cabinet and the volumes of the shelves, partitions and baskets essential for the proper operation of the cabinet, provided each part is of more than 0·25 litre. This volume will be obtained after deducting from the gross, the following and also the volume of any other space which is identified as unusable for storage of food, provided that its individual volume is greater than 0·25 litre or its thickness or width is greater than 13 mm:

a) Volume occupied by parts necessary for proper functioning of the freezer, such as evaporator material, evaporator doors, cooling coils, evaporator ribs and suction header;

b) Volume between the deductable door projections and adjacent liner walls; and

c) Volume occupied by fixed partitions or projections, such as control knobs, shelf hangers, shelf and tray rails or basket supports which individually occupy a volume of more than 0·25 litre and have a width or thickness of more than 13 mm.

4.5 Volume of Shelves Partitions and Internal Fittings — The volume of a shelf, partition or internal fitting (excluding baskets) shall be the product of its area and thickness. The area of a shelf shall be the product of its width and depth. Where part of the shelf is cut away, the area of the cut-out shelf shall be deducted. Where the edge of the shelf is not more than 25 mm from the cabinet lining the shelf shall be considered as extending to the lining for the purpose of calculating shelf area. Where there is an access door in a wall of the cabinet, the inner surface of the door shall be considered as being the inner surface of the lining.

4.5.1 The thickness of the shelves and partitions shall be the distance between the outer surface excluding the edges, where those are reinforced (*see* Fig. 1). Where surfaces are corrugated or fitted with pipe grids, the plane through the apices of the corrugations or pipes shall be used for calculating volumes except that where the clear distance between adjacent corrugations or pipes is greater than 100 mm the surface itself shall be used and a volume shall be deducted for each corrugation or pipe equal to the product of the width, the distance from the surface to the outside of the corrugation or pipe and the length of the corrugation of pipe.

4.6 Volume of Baskets — The volume of baskets to be deducted from the gross internal volume in the determination of storage volume shall include the space not available for storage at each side and end of the basket and the volume of the bottom of the basket (*see* Fig. 2).

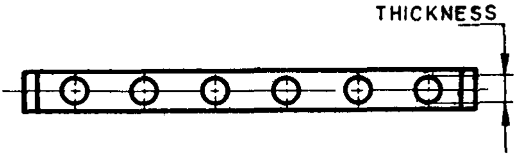


FIG. 1 THICKNESS OF SHELVES

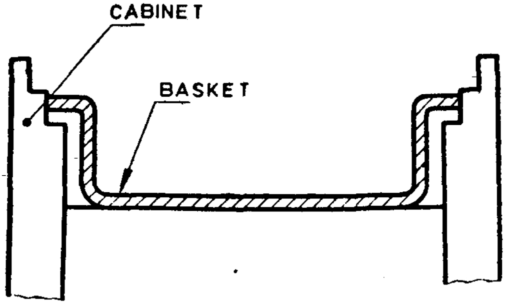


FIG. 2 DEDUCTION OF VOLUME FOR BASKET

4.7 Full Partitions — The volume of a full partition is the product of its thickness, depth and width or height. This depth, width and height are those dimensions of the cabinet applicable in the plane of partition.

4.8 Fractional Partitions — The volume of a permanently fixed fractional partitions is the product of its thickness, depth and width or height, whichever of these two is applicable. The depth, width or height are the distances normal to the lining from adjacent surfaces to the further edges of the partitions or to the evaporator in case the fractional partition touches it. A horizontal partition the edges of which are more than 70 mm from the lining of the cabinet is regarded as fractional partition. A vertical partition, the edges of which are more than 100 mm from the lining of the cabinet, is regarded as a fractional partition.

4.9 Suspended Containers — The area of the bottom of a suspended container and the area of the shelf beneath shall not both be counted unless the vertical clearance between this shelf and the bottom is at least 100 mm. If the mean depth vertically of a suspended container as measured between its bottom and the cover or shelf immediately above is less than 40 mm the bottom area of the container shall not be added.

4.10 Rated Gross Volume — This shall be the gross volume as declared by the manufacturer in cubic decimetres or litres. The measured gross volume as described in **4.3** shall not be less than the rated gross volume by more than 5 percent.

4.11 Rated Storage Volume — This shall be the storage volume as declared by the manufacturer in cubic decimetres or litres. The measured storage (net) volume as described in **4.4** shall not be less than the rated storage volume by more than 5 percent.

5. PERFORMANCE REQUIREMENTS

5.1 No-Load Test — It should be possible to obtain the following temperatures at least for one setting of the thermostat at an ambient temperature of 43°C:

a) The average air temperature in the freezer shall not be above – 15°C.

b) At any part of the freezer or the storage compartment, the temperature measured at the points shown in Appendix A shall not be above – 12°C.

5.2 No-Load Performance Test

5.2.1 *Pull Down Time* — With the freezer working under no load and without the thermostat in the circuit, at ambient temperature of 43°C, the time required to pull down the average freezer air temperature from 43°C to – 15°C shall not exceed 6 hours.

5.2.2 *Power Consumption and Percentage Running Time* — With the freezer working under no load and with the thermostat operative in circuit, at ambient temperature of 43°C, the unit shall run for at least 12 hours after the average air temperature of – 15°C has been maintained. During this time the power consumption and the percentage running time shall be measured. Both these parameters shall not exceed the value stated by the manufacturer, by more than 5 percent.

6. TESTS

6.1 Classification of Tests — Tests shall be classified into the following three groups:

a) Type tests,

b) Production routine tests, and

c) Acceptance tests.

6.1.1 *Type Tests* — Following shall constitute the type tests:

- a) Door seal test,
- b) Test for mechanical strength of shelf and similar components,
- c) Thermal insulation test,
- d) Pressure test,
- e) High voltage test,
- f) Insulation resistance test,
- g) Performance test, and
- h) Product load test.

6.1.1.1 Two freezers of each size shall be sent along with manufacturers detailed specifications to the recognized testing authority for purposes of type tests. The samples shall be picked up at random from stock or routine production.

6.1.2 *Production Routine Tests* — Every freezer after completion shall be subjected to the following routine tests at the manufacturer works, without loading the freezer:

- a) Thermostat test,
- b) Insulation resistance test,
- c) Door seal test, and
- d) High voltage test.

The manufacturer shall furnish with each freezer a certificate that the production routine tests prescribed have been conducted in accordance with the procedure given and that the unit conforms to the requirement of the standard, as described under **6.3**.

6.1.3 *Acceptance Tests* — If the purchaser desires any of the production routine tests to be repeated, where agreed to between the purchaser and the manufacturer, the test may be conducted at the manufacturer's work and the number of samples for these tests shall be as agreed to between the manufacturer and the purchaser.

6.2 Type Tests

6.2.1 *Door Seal Test* — The purpose of this test is to ensure that the gasket of the door of the deep freezer adequately prevents any ingress of the surrounding air. With the freezer at rest, a strip of paper 50 mm wide 0·08 mm thick and of suitable length shall be inserted at any point of the seal and the door closed normally on it. The strip of paper shall not slide freely.

6.2.2 *Mechanical Strength of the Shelves and Similar Components* — The purpose of this test shall be to check the mechanical strength of the components used for storing food, that is shelves, containers, baskets, etc, with the freezer at rest and the door open the test shall be conducted as follows:

> The components to be tested shall be, in turn, loaded with 80 mm diameter cylindrical weights of 1 000 g each (only 500 g in case of components above which the clear height in normal service cannot exceed 150 mm). The weight shall be placed with their axis vertical for one hour in such a way that the maximum possible number is accommodated without one weight being placed over the other and without overhanging the edge of the shelves under test. The components under test shall remain in position throughout the test and shall show no visible distortion after removal of the weights.

6.2.3 *Thermal Insulation Test* (*External Condensation Test*) — The freezer shall be held with an average internal temperature between – 15°C and – 10°C in an ambient temperature between 31°C and 33°C. It shall be considered satisfactory if, when the relative humidity of the ambient air is held between 70 to 75 percent, condensed moisture is not visible on the outer surface of the freezer to the unaided eye of a trained observer during a period of time lasting for 12 hours after the test conditions have become stable.

6.2.4 *Pressure Test* — All parts of the refrigerating system subject to internal pressure shall be tested. No part of the assembly under test shall show signs of leakage or permanent deterioration after subjecting to the appropriate pressure given in **3.10.5**.

6.2.5 *High Voltage Test* — Electrical insulation of all electric circuits included in the freezer shall be such as to withstand a high voltage test of 1 000 volts rms applied for not less than 2 seconds between all electric circuits and all accessible metal parts (electrically connected together for this test) at normal room temperature. The test voltage shall be alternating, of approximately sine-wave form, and of any convenient frequency between 25 and 100 Hz.

6.2.6 *Insulation Resistance Test* — Insulation resistance between all electrical circuits included in the freezer and the earthed metal parts when measured at normal room temperature with dc voltage of 500 V shall not be less than one megaohm.

6.2.7 *Performance Test* — This shall be carried out as described under **5**.

6.2.8 *Product Load Test* — Test packages shall be constructed as described below:

a) The frozen food equivalent to be used for filling the test packages is prepared from hardwood sawdust which has been soaked in an aqueous solution of sodium chloride having a specific gravity of 1·02.

b) The sawdust soaked for three days is allowed to drain and is then packed in wrappers of plastics film of such properties that transfer of humidity to or from the ambient medium is negligible.

c) After filling, the wrapper is sealed and each package inserted into a non-metallic plain carton of moistureproof material.

d) The prepared sawdust is packed to give an overall package density of 480 ± 80 kg/m^3.

e) These test packages may be filled with any suitable material having similar thermal characteristics to those of the material specified above.

f) Test packages to be used for temperature measurement shall each be fitted with a thermocouple located at the geometric centre of the package and shall measure 50 mm × 100 mm × 100 mm.

g) Test packages other than those fitted with thermocouples used to fill up the net storage volume, shall be made up in a similar way to the following dimensions:

40 mm × 100 mm × 200 mm or
25 mm × 50 mm × 100 mm

6.2.8.1 *Test procedure* — The cabinet shall be filled up to the load limits in accordance with the manufacturer published recommendations with the test packages at a temperature declared by the manufacturer and the cabinet shall be operated in an ambient of 32°C for at least 2 hours after thermal equilibrium has reached. Temperature of test packages are taken at three to six geometrically equally spaced centres in the freezer cabinet. Readings shall be recorded at intervals not greater than 30 minutes. Maximum and minimum temperatures of each cycle shall be recorded. The maximum temperature of the test packages shall not exceed the temperature declared by more than 3°C.

The test temperature of the test package shall be measured in such a way that the temperature sensitive part of the thermometric device shall be in the form of square sheet of copper having sides of 25 mm and thickness of 0·56 mm and shall be inserted at the geometric centre of the test package.

6.3 Production Routine Test

6.3.1 *Thermostat Test* – Thermostat setting should be such that when set at any point, it should not cut in before the system pressure is balanced to such an extent that the compressor can take a start without tripping.

6.3.2 *Insulation Resistance Test* — This shall be carried out as given in **6.2.6**.

6.3.3 *Door Seal Test* — Door seal shall be tested for tightness as described in **6.2.1**.

6.3.4 *High Voltage Test* — This shall be carried out as given in **6.2.5**.

7. GENERAL TEST CONDITIONS

7.1 Freezer Installation — Unless otherwise specified, the test shall be made on the freezer installed as for normal use with shelves, baskets and other fittings, if any, in their normal positions in accordance with the manufacturers instructions, with all containers being empty.

7.2 General Operating Conditions — Prior to the start of all tests, the unit should be defrosted and cooling unit and the interior of the cabinet dried. Units should be switched on after all the internal parts have achieved the ambient temperature of the test. The freezer shall then be allowed to operate at the ambient temperature of the test for at least 12 hours to establish the thermal equilibrium.

Stable operating conditions are deemed to be reached when during a time of 2 hours the mean temperatures measured at the same position of the control cycle do not vary than by more 0·5°C from the final regulated figure.

Stable operating conditions are deemed to be maintained during the test when the temperatures measured at the same moment of the control cycle do not vary by more than 0·5°C during 12 hours.

After the main internal temperature has been changed, the freezer shall be left for at least 5 hours before another test. After the ambient conditions in the test room have been changed, the freezer shall be left for at least 12 hours before another test.

7.3 Electrical Power Supply — For the test during which the freezer will be in operation, electric power supply shall not vary by more than ± 2 percent of the rated voltage.

7.4 Test Room Ambient Temperature — The test room shall be capable of being maintained at 32 ± 1°C and 43 ± 1°C. The vertical ambient temperature gradient from the platform as specified to a height of 2·1 metres shall be within 1°C for each 1 metre of vertical distance.

7.5 The freezer should be placed on a separate solid top platform resting on four legs so as to permit a free air circulation under the platform. The top of the platform should be 30 cm above the test room floor and should extend at least 30 cm but not more than 60 cm beyond each side of the freezer. The freezer shall be so placed or shielded as to prevent direct radiation from the test room heating equipment. Air circulation of the test room shall be such that the specified ambient temperatures are obtained within the limits of the specified tolerances. The freezer under test shall be shielded from direct air currents and the circulation of the air around the freezer shall be restricted to 15 metre/min and if required by suitable false partition.

Before the stablisation period preceding the test, the interior of the food storage compartment or compartments shall be dried. The doors of the food storage compartment or compartments shall be kept closed during the test.

8. MEASUREMENTS

8.1 Measuring Instruments

8.1.1 The watthour meter shall be accurate to at least ± 1 percent.

8.1.2 The temperatures shall be measured with thermocouples, or other temperature measuring probes, which are inserted in the centre of a copper mass weighing 25 g and of minimum external area (diameter = height = about 15·2 mm).

8.1.3 Relative humidity shall be measured either by means of ventilated psychrometers having thermometers of an accuracy of 0·5°C or with recording apparatus of equivalent accuracy. When psychrometers are used, it shall be necessary to carry out measurement at regular intervals.

8.2 Temperature Measurement Conditions

8.2.1 *Ambient Temperature* — Ambient temperature shall be maintained within ± 1°C of the specified value and shall be measured at 25 cm from the sides and front of the cabinet and at the height of the geometric centre of the front and sides. This condition shall be maintained during both stabilization and test period.

8.2.2 The ambient temperature shall be recorded at one of the above positions preferably with a recording instrument. If an indicating instrument is used, reading shall be taken at intervals not greater than 30 minutes.

8.2.3 Temperatures may be read or preferably recorded. The temperature sensitive element of the temperature measuring instrument shall be separated from any heat conducting surface by at least 13 mm of air space. Connections from the measuring instruments shall be arranged in such a manner as not to interfere with the air-seal of the storage compartment.

8.2.4 All instruments used for measuring shall be calibrated against master instruments of certified accuracy.

8.2.5 Temperature measuring instruments shall be accurate to 0·25°C.

8.2.6 Watthour meters shall be capable of being read to 0·01 kWh.

9. MANUFACTURER'S CERTIFICATE

9.1 The manufacturer shall furnish with each freezer a copy of the type test certificate and shall also certify that the freezer has been manufactured according to the type tested by the testing authority and that it conforms to the requirements of this standard.

9.2 The manufacturer's certificate shall not be necessary unless specifically demanded by the customer if the freezer bears the ISI Certification Mark (*see* **10.1.1**).

10. MARKING AND INFORMATION

10.1 Each freezer shall have the following information marked in a permanent and legible manner on one or several locations where it is readily visible:

a) The manufacturer's name and the trade-mark,
b) The model (or commercial designation) of freezer and Sl No.,
c) The rated gross volume in cubic decimetres or litres,
d) The rated storage volume,
e) The name of the refrigerant used in system and its quantity,
f) Full load current,
g) Wiring diagram,
h) Voltage or voltage range, and
j) Nature and frequency of supply in case these have to be observed.

10.1.1 Freezers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

10.2 Each freezer shall be accompanied on delivery by instructions for its use and maintenance printed on strong paper, cardboard or similar material. These instructions shall at least provide information relating to:

a) installation requirements (in particular levelling of freezer);
b) conditions of operation (starting, stopping);
c) use of various control devices (thermostat, defrosting, etc); and
d) maintenance and cleaning the freezer.

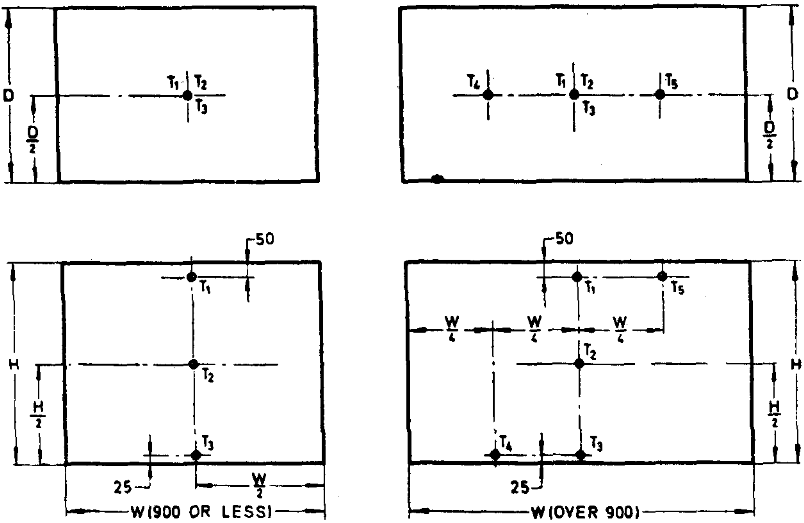
10.3 If desired by the buyer, the following information shall be furnished by the manufacturer:

a) Overall dimensions,
b) Rated power consumption, and
c) Rated storage volume.

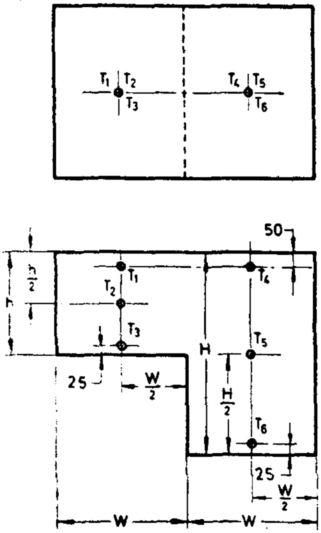
APPENDIX A

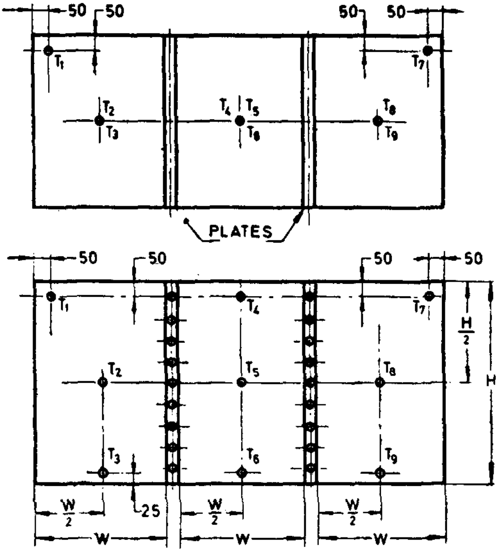
(*Clauses* 2.6 *and* 5.1)

THERMOMETER LOCATIONS FOR TEMPERATURE MEASUREMENTS



REFRIGERATED WALLS, TOP ACCESS





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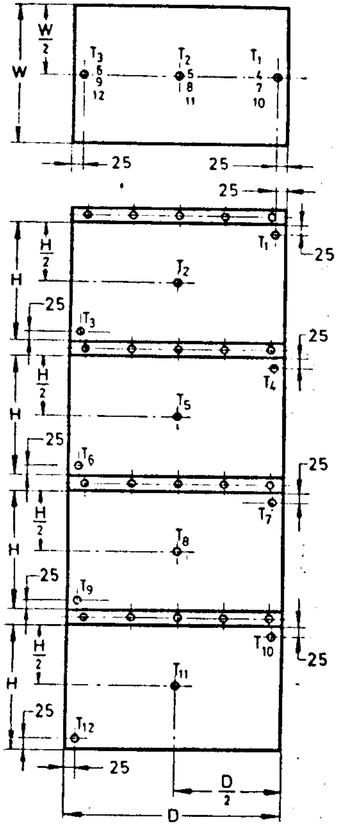
REFRIGERATED PLATES, TOP ACCESS



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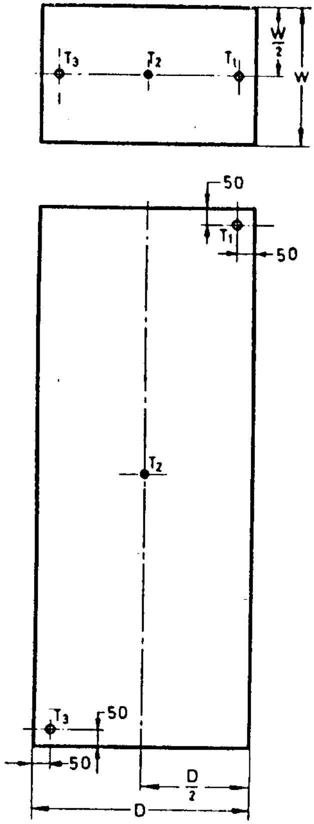

REFRIGERATED WALLS, FRONT ACCESS

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‡Sales Office in Bangalore is at Unity Building, Narasimharaja Square, Bangalore 560002 22 36 71

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 JUNE 1991

TO

IS 7872 : 1975 SPECIFICATION FOR FREEZERS

(*Page* 12, *clause* **5.2.2**) — Substitute the following for the existing clause:

'**5.2.2** *Percentage Running Time* — With the freezer working under no load and with the thermostat operative in the circuit at ambient temperature of 43°C, the unit shall run for at least 12 hours after the average air temperature of −15°C has been maintained. During this time percentage running time shall be measured. Percentage running time shall not exceed the value stated by the manufacturer, by more than 5 percent.'

(*Page* 12, *clause* **5.2.2**) — Insert the following new clause after **5.2.2**:

'**5.2.3** *Energy Consumption* — The maximum energy consumption for freezers of different storage capacities with the freezers working under no load and with the thermostat operative in circuit at 32°C ambient temperature and −15°C internal storage cabinet temperature shall be as given below:

Storage Capacity (litres)	*Maximum Energy Consumption/24 h* (kWh)	
	Static Cooled	Forced Cooled
165	5	4
240	6·5	5
400	7·5	6·5
630	8·5	7·5'

(HMD 3)

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